



Digital Asset Working Group Report

June 2019



Contents

Executive Summary	1
Level-setting	4
Market Context	4
Survey Results	5
First Survey – November 2018	5
Second Survey – February 2019	7
Drivers for adoption across the digital asset value chain ..	12
Token Definitions & Taxonomy	14
Defining Tokens	16
Token Data Structures	17
Specific implications for tokens in financial markets	19
Key Regulatory Considerations for Tokenizing	
Assets in the EU and UK	19
Tokenomics & governance sub-group input	22
One specific area this group is taking forward	25
Projects going forward	25
Decentralised Finance	25
Why is DeFi important for financial	
institutions to watch?	25
How is DeFi different from what came before it? ..	25
What are some of the larger projects?	26
Next Steps	26
About R3	27

Executive summary

The digital asset ecosystem is the most exciting area for blockchain technology, and it has massive implications for the way businesses interact in every industry. This is most immediately relevant in capital markets, where the ability to represent assets and transact over digital rails with new models of trust is changing the way that capital acquirers and allocators interact.

Innovation in digital assets has always been oriented to connecting issuers and investors in more efficient and valuable ways. The financial crisis of 2008 provided a moment of opportunity, which bitcoin and blockchain technology seized in the following years. The Ethereum ecosystem presented a new world of digital assets, which culminated in a bubble itself in 2017, when capital was allocated to projects with weak business cases. The market is moving to take advantage of blockchain infrastructure, but is focusing on real enterprise use cases and institutional scale. It was in this environment that R3 – a blockchain software technology company – brought together a group of 50 organizations and 100 participants, all of whom are active in the digital asset market.

The working group was framed by two sets of surveys intended to establish market readiness and the outlook for digital assets, as well as identify the major

opportunities and hurdles for the market. Surveys showed the following:

- **Blockchain-enabled digital assets are primarily a revenue opportunity, held back somewhat by regulatory uncertainty.**
- **The most significant impact will be in digital representations of real assets and digitally native securities.**
- **Most organizations plan to have products in the market in these areas in the next 1–5 years. The most powerful forces for market advancement are digital-first exchanges and new models for custody of digital assets, which fits with a broader market theme of an evolving and expanding role for both exchanges and custodians in the digital asset space.**
- **The distributed nature of blockchain business networks offers advantages (verifiable provenance) and challenges (if one is using PoS).**

There is little doubt that the ability to create smart contracts and put more automation into digital assets directly adds significant value through the capital markets lifecycle and may make middle and back office functions more efficient. For all of this to be possible, the market needs clear standards on asset issuance, exchange, settlement, and management.

The DAWG produced multiple sub-working groups, which addressed different aspects of the digital asset ecosystem. These included “Digital Asset

Taxonomy & Definitions,” “Legal and Regulatory Considerations,” “Digital Asset Network Governance,” and “Go-Forward Projects.”

The DAWG put forward a taxonomy and definition of digital assets, to help participants use and custody assets from both a technical and business sense. This taxonomy is purposefully aligned to the many digital asset taxonomies taking shape in the market, in which R3 and other DAWG participants are actively involved. The purpose of this effort was to go further than a simple taxonomy and provide a reference model for how digital assets can be represented in code and how they are recognized by existing laws and regulations. The Legal & Regulatory group shared implications from an EU and UK legal perspectives, including MiFID and CSD-R applications. This assessment highlighted the importance of regulated Security Settlement Systems and the role of custodians in a market where participants can manage or delegate ownership of digital assets and private keys. The Governance group examined considerations of network governance, which changes based on the consensus mechanism, the stakeholders in the network, and the way the network participants execute changes to the network.

The primary product of the DAWG as a whole was the identification and assessment of the market drivers for digital asset market adoption. Those drivers are framed within the

digital asset value chain, which includes issuance, registration, exchange, settlement, and management. The general requirements for market scale and institutional adoption of digital assets are clear standards,

transaction finality, flexible custody models, and a solution to include verifiable identity. Finally, this paper addresses a few opportunities for projects going forward. For example, the Decentralized Finance (DeFi)

trend is producing interesting projects and innovations in financial markets.

The Digital Asset Working Group included participants from the following organizations:

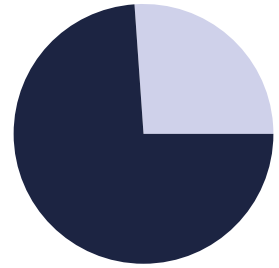
Allen & Overy	CLS	ING	PIMCO
Alliance Bernstein	Commerzbank	Intel Capital	R3
ATB	CU Ledger	Itau	SBI
B3	Deutsche Bank	Latham & Watkins	SocGen
BAML	Deutsche Boerse	Linklaters	State Street
Barclays	DLA Piper	LSEG	Trowe Price
Blackrock	DTCC	Mizuho	UBS
BNC	Euroclear	NatWest	US Bank
BNP Paribas	Fidelity	Nomura	Westpac
BNY Mellon	Fintertech	Northern Trust	WSGR
Cambridge Judge Business School	Goldman Sachs	Numerate	
Citi	ICICI	Perkins Coie	

APAC READOUT HIGHLIGHTS DIGITAL ASSET IMPACT

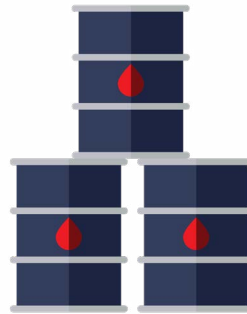
On May 22nd 2019, over two hundred and fifty participants joined R3 at Singapore Management University to hear takeaways from the Digital Asset Working Group (DAWG) and to discuss the findings in the context of the Asian market.

Live surveys of the participants further validated initial DAWG responses.

74%

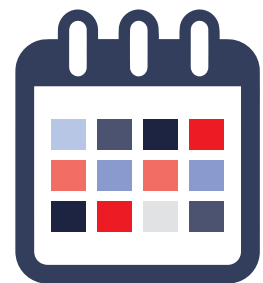


of participants pointed to “tokenized assets” as having the most important impact on their organization as opposed to “cryptocurrency” (19%) or “neither” (17%).



Network fees (specifically “gas” to use Ether) was a significant impediment for the use of the cryptocurrencies that underlie public blockchains.

1-5 Years



Similar to DAWG findings, respondents said it would take their organizations one to five years to roll out products and services around digital assets.

Level-setting

Market context

Across use cases, issuers and investors have always existed as the two primary parties to a transaction. An issuer is a party who makes a promise to the marketplace and an investor buys that promise by spending money or deploying capital. That promise could be a commitment to deliver a good, provide a service, or build a business. The investor is buying that good, service, or share of profits. We can call that promise an asset.

As markets developed, banks were employed as trusted safe-keepers of assets. They evolved to provide access to markets. In fact, financial institutions provided expanded roles across the transaction value chain, becoming the infrastructure that connects issuers and investors in all types of markets. This expansion of roles includes risk-taking functions, marketing, broking, and the original intermediary function: custody.

Custodians began to represent assets in digital form in the 1960s. Computers provided a fundamentally better way to record assets, track movements, and maintain accounts. The way issuers and investors interacted is always changing. From face-to-face arrangements, to mail, to voice trading, to electronic markets. Technology is always being applied to make this process easier.

Technology also allows for increasing complexity in assets and how they are created.

As complexity increased, trusted custodians picked up another critical market function: reconciliation of asset composition and ownership.

2008

The financial crisis had many proximate causes, but the market's structural weakness was the origin. Financial markets did not accurately value assets and their risk profiles. Further, asset holders did not understand the relationships between assets, which was largely due to the complexity enabled by technology in capital markets. Complex securitization made it difficult to assess and manage risk. When one segment of an asset class - retail mortgages - underperformed, a potentially limited weakness destroyed significantly more value, with wide-ranging negative results.

The financial crisis caused us to re-think intermediaries, market structures, and the basis of the promises issued. New regulation was introduced, which fundamentally changed market structure and the role of participants in the financial asset value chain. In the recovery and associated market structure changes, trusted intermediaries and custodians were limited from revenue opportunities and picked up additional risk controls which added cost and process. This was paramount.

In the ten years since the recovery began, major markets have been on an extended bull run, and financial intermediaries have been asked to deliver better financial results despite

the additional costs incurred. This is causing pain for financial institutions and dissatisfaction among the most important parts of the value chain: issuers and investors of assets.

Bitcoin

With one whitepaper that built on decades of cryptographic research and development, Satoshi Nakamoto proposed a system for anonymous, independent parties to transact with assurances against double-spends. Bitcoin began as an interesting solution to preventing double-spends (fraud) and showed how distrusting parties could reach consensus about the state of a global ledger through cryptographic proofs. It was most interesting to institutions and enterprises not as a medium of exchange or store of value, but as a new model for creating trusted transactions between distrusting parties. This took off as blockchain technology.

Ethereum

The public blockchain community took this innovation forward, using the underlying technology of Bitcoin to create new applications and networks. Blockchain technology was quickly applied to reconciliation use cases across industries, but especially in capital markets. Tokens - native representations of promises on a distributed network - were shown to be a new and different way to connect issuers with investors. The public blockchain community took this forward with massive fundraising operations in which investors bought tokens representing

securities or “utility” value for future use in the platform. This market brought forward important innovations in both the ability to represent assets digitally and direct custody of digital assets.

However, many of the businesses that raised money through the public blockchain markets lacked robust business plans or solid governance practices. The retail nature of many exchanges encouraged speculation and a “greater fool” theory of investing. This correlated to a significant drop in public blockchain token prices.

Enterprise Opportunities and Requirements

Out of this market downturn, enterprises realized there could be a better way to issue and invest in digital assets. Between digital representations of assets, direct custody, and peer to peer transactions, the advantages of blockchain technology demonstrated real promise. Issuers, investors, and market infrastructure providers are investing in blockchain technology with real business plans and regulated securities markets.

It was in this context that R3, an enterprise blockchain company already working with financial institutions and corporates, brought together 48 organizations across three

continents to form the Digital Asset Working Group (DAWG). The participants came from financial institutions, traditional financial market infrastructure, fund managers, and law firms. The primary goal of the DAWG was to determine the market requirements and capabilities that would drive real market adoption of digital assets in capital markets. The participants held discussions about various aspects of the digital asset ecosystem, and also heard presentations from solution providers such as digital asset issuance platforms, digital custodians, settlement asset issuers, and digital asset exchanges.

Survey results

The Digital Asset Working Group sought feedback from members via two surveys, the first was at the outset of the group, and the second came approximately halfway through the six-month project.

The first survey covered the goals of the working group, and respondents’ views on digital assets. The first survey had 18 respondents from across the financial industry, and related professional services firms.

Respondents were given a working definition for digital assets as follows:

For the purposes of this survey, we define digital assets as a ledger-based asset, either:

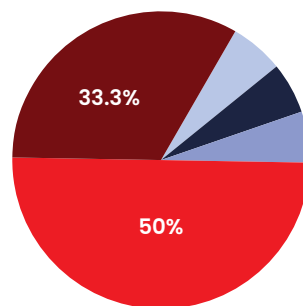
- **Assets native to Distributed Ledger (“DL”), in which the ledger is the account of record (including cryptocurrencies), or**
- **Assets immobilized, dematerialized, and/or held off chain, but represented on DL.**

First Survey – November 2018

All respondents were then asked their views on positive and negative aspects of digital assets. Approximately half of those responding viewed the main positive benefit as revenue opportunities, with a further third seeing cost reduction as the main benefit.

The most important positive impact of digital assets on our business will be:

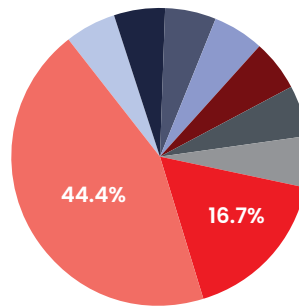
18 responses



- Revenue opportunities
- Cost reduction
- Regulatory treatment
- Capital/balance sheet reduction
- All
- Unclear at this time
- Revenue is only part of it. Industry growth is another

The most important negative impact of digital assets on our business will be:

18 responses



- Revenue loss
- Cost increase
- Regulatory burden
- Capital/balance sheet increase
- Cost and risk of implementation
- Business retention
- Dual costs and complexity in the ad ...
- Unkown

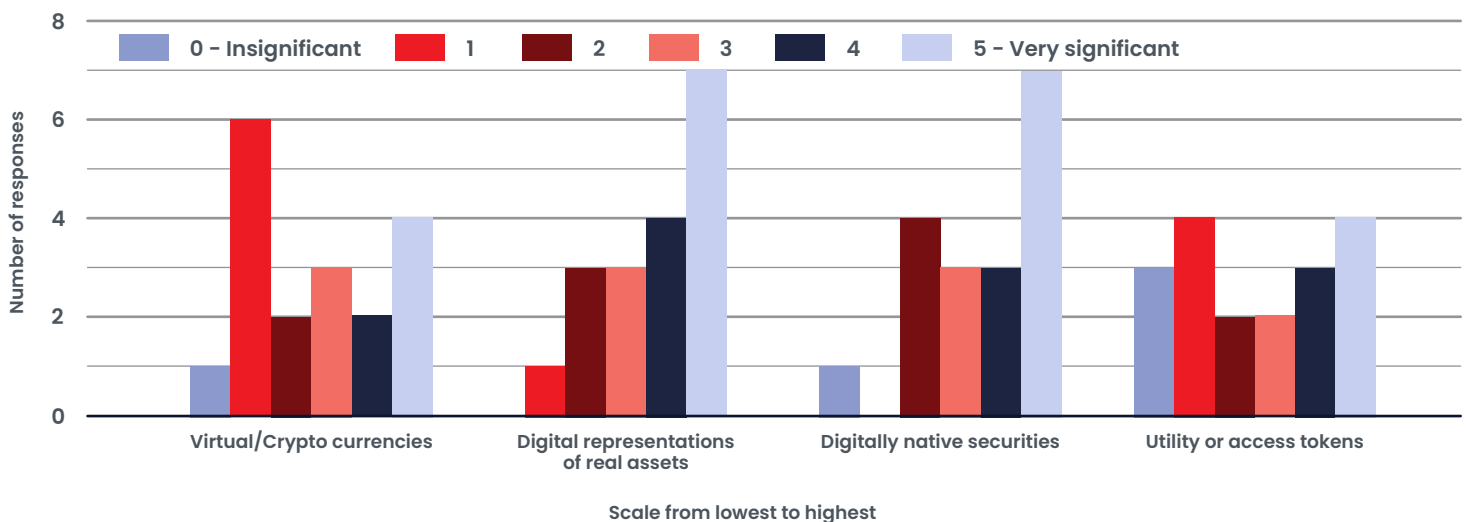
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When asked about which categories of digital assets respondents saw as potentially having the greatest impact, they suggested that the tokenization,

whether as representation of other more traditional assets, or natively issued (e.g., bonds issued tokens), would be more

impactful for their businesses. Cryptocurrencies and utility tokens received a slightly more mixed reception.

Rate the impact that the following types of digital assets will have on your organization (medium to long-term):



Further to this, respondents were asked specifically which types of digital asset products they saw as having the most impact on their businesses. More common responses included:

- **Legally recognized smart contracts**
- **FMI functions (depository, settlement, registry)**

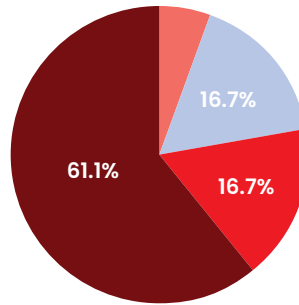
- **Digital Cash**
- **Asset backed tokens**
- **Securities tokens/tokenized securities**
- **Lending/financing tokens**

Respondents were also fairly confident about the prospect of their organizations offering

products and solutions for digital assets, with one-third of respondents indicating that they currently have an offer or see their organization bringing an offering within a year. A further 61% indicated that their organization would bring an offer in less than five years.

What is the timeline for your organization to offer products or services on digital assets?

18 responses



Second Survey - February 2019

A second survey, taking place approximately three months after the working group with largely the same base of respondents, provides an update on respondents' views on the

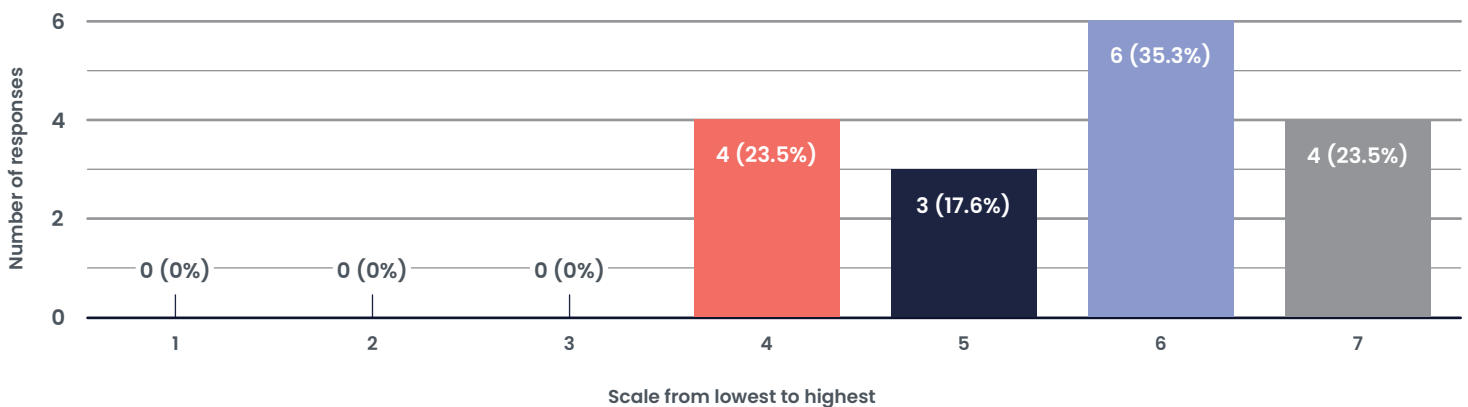
market appetite for digital assets, as well as particular issues and opportunities discussed amongst the members.

One issue of discussion which arose as part of the working group was the role that financial market infrastructures (FMIs)

and exchanges played, and how they would be critical in fostering adoption of digital assets. Respondents to the survey largely welcomed the notion of these entities adopting a digitally native approach, which could lead to the support of these new asset types.

New exchanges and market infrastructure built from a "digital-first" perspective would be an advantage to my business:

17 responses



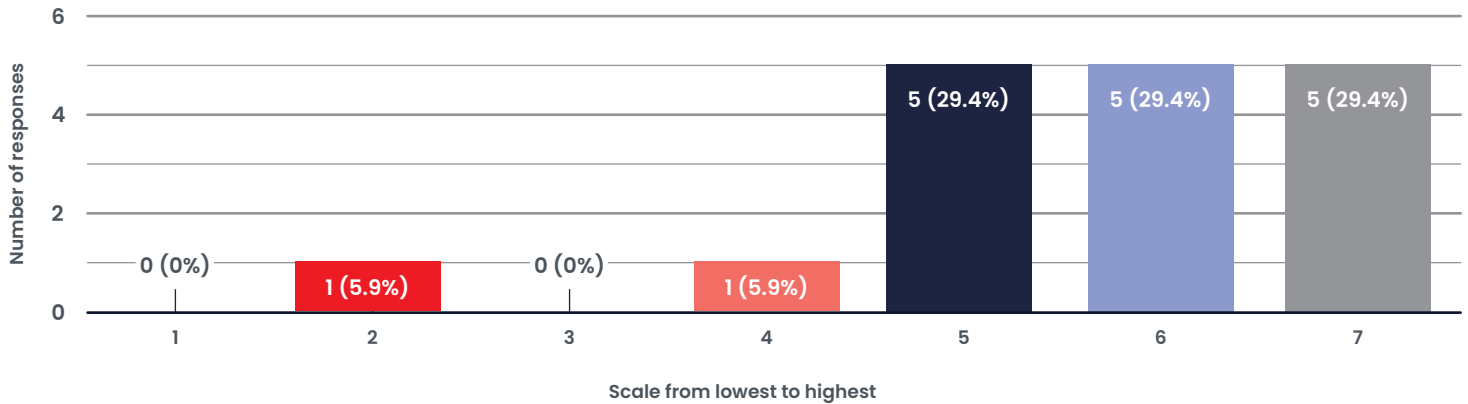
Another aspect related to digital assets was the ability for a flatter custody structure than currently

exists. Many respondents viewed this positively. Presumably entities currently involved in offering

custody services saw this as less desirable, which was reflected in at least some responses.

The ability to directly custody assets is appealing to my business:

17 responses



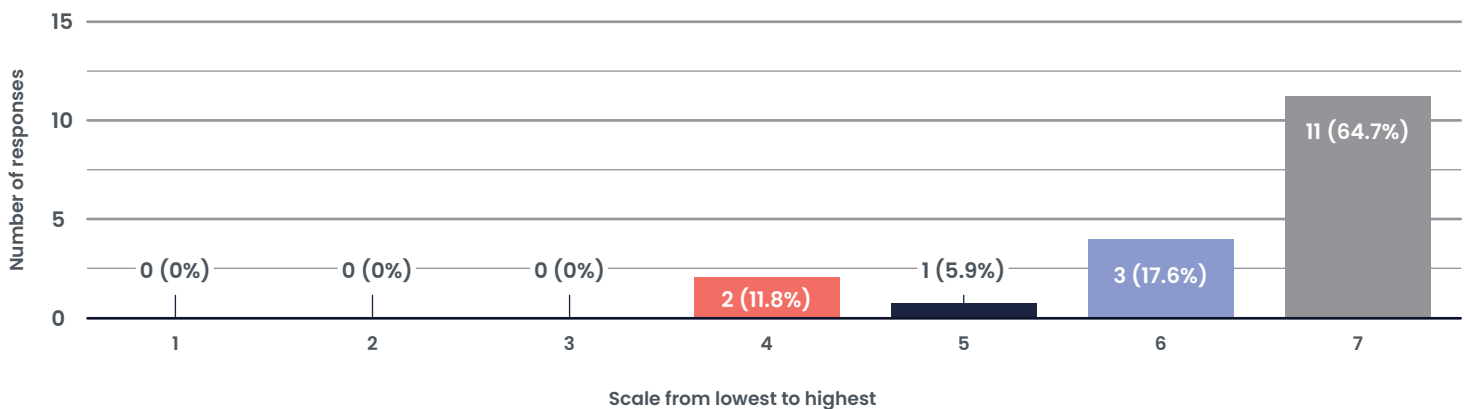
Another point of discussion was how digital assets are secured. Looking at the method utilized in cryptocurrencies and tokens, public-private key pairs,

participants were concerned about loss of private keys. Even if it were possible to recover keys, this could still create issues for

providers and their clients. This aspect should be considered if offering such a solution to institutional markets.

The risk of key loss (even if recoverable) is of significant concern:

17 responses



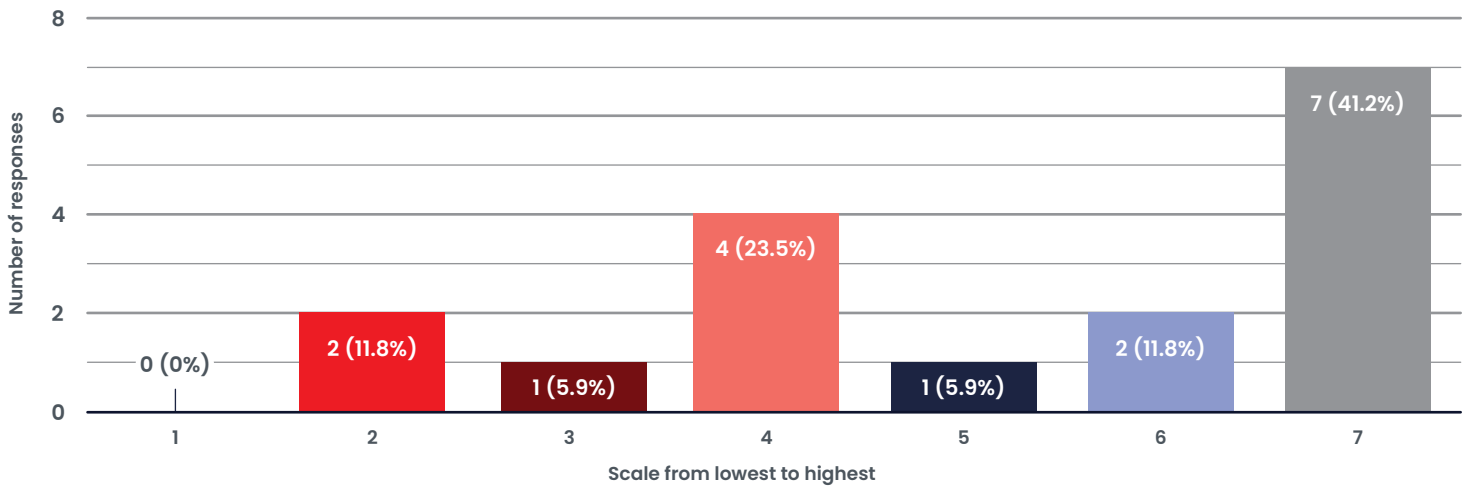
The need to pay for transaction fees for using a cryptocurrency (e.g., ETH) is a unique aspect to the operation of tokens on permissionless blockchains. While this may be something that requires education or more mature infrastructure, it could also have unintended

consequences that slow adoption of digital assets on these types of networks. Some participants noted the difficulty in acquiring cryptocurrencies for experimental purposes. Scaling applications on permissionless blockchains to product may require changes in processes

and controls across large institutions. Some respondents did not see this as a major hurdle, while just over half stated that it would be a considerable impediment for adoption of digital assets.

The requirement to use a cryptocurrency (e.g. Ether) to pay network transaction fees is a significant impediment for adopting digital assets:

17 responses



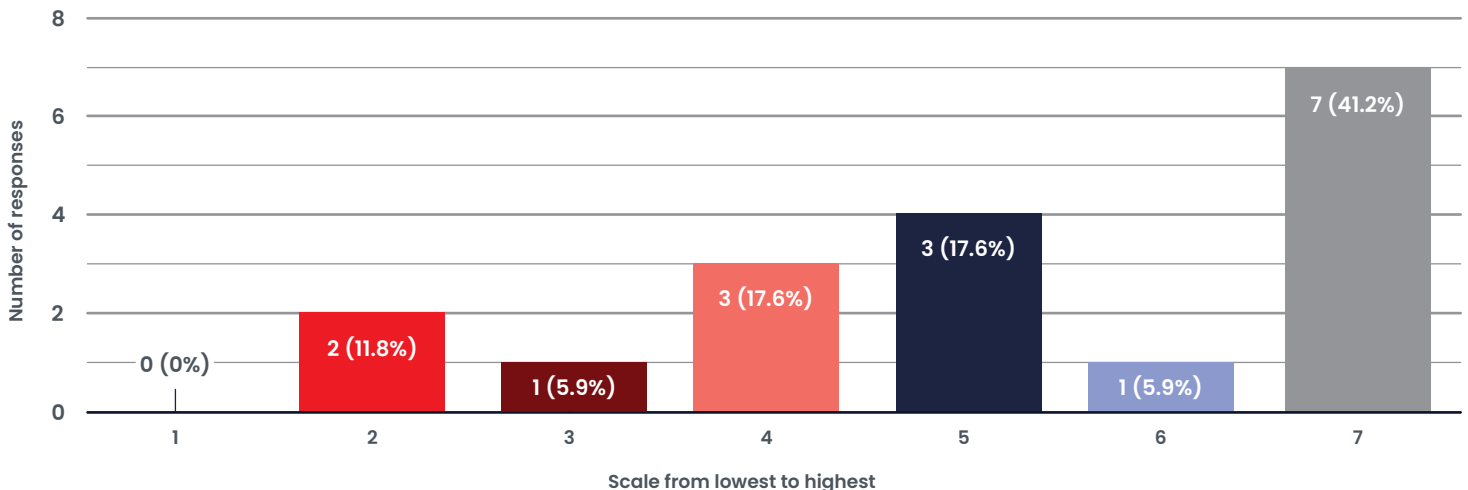
Respondents also looked at how a distributed ledger could lend itself to providing a full history of an asset. Responses were overall

positive, seeing benefits for compliance and cost reduction, however some respondents

noted that this could pose issues related to banking secrecy rules, and frontrunning.

Having the ability to identify the history of where an asset has been, back to its creation is appealing my business:

17 responses



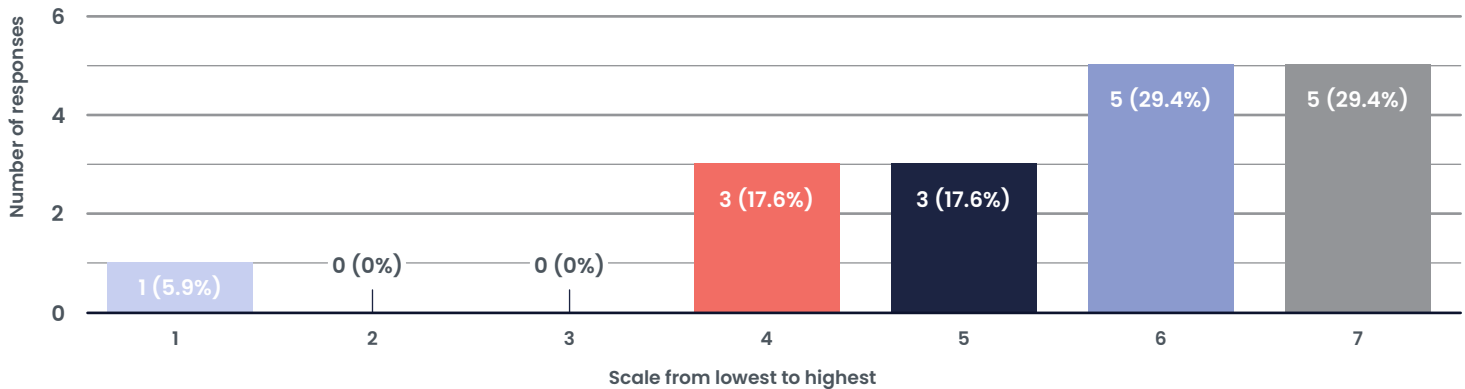
Another area which factored in the compliance and cost reduction discussion was how data could be referenced. Digital assets in some forms,

owing to their full histories being available, tie data permanently to the asset. Contrast this with current methods which

require each entity to store considerable amounts of static data themselves, which is often reconciled with other entities.

Attaching data to the asset itself, as opposed to each owner recording data in their own systems, would add value:

17 responses



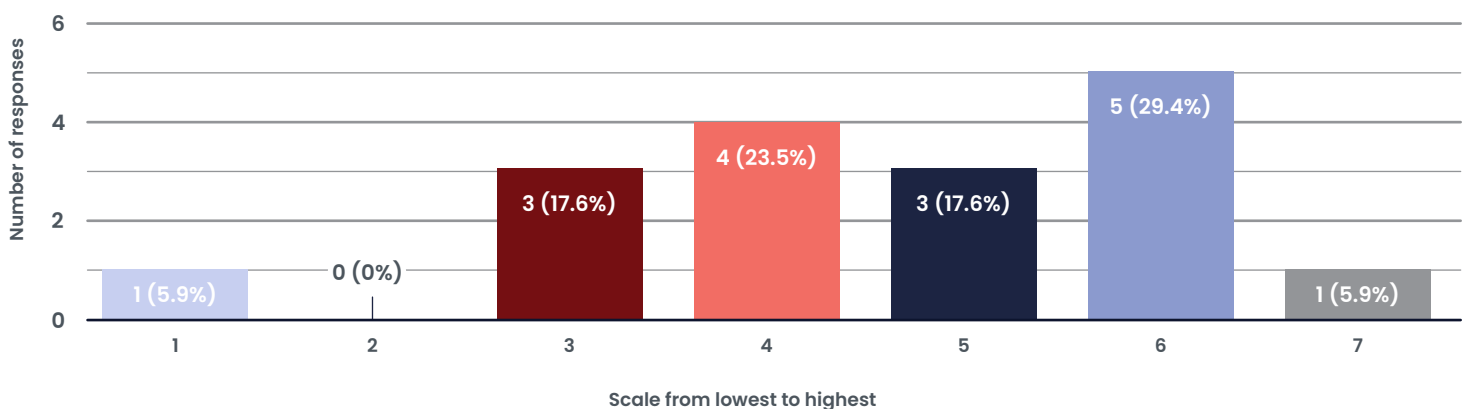
One potential benefit cited for the use of digital assets was greater efficiency of the life cycle of a trade. Responses tended positive but were mixed on this aspect. Discussions suggested that many

reasons for inefficiencies in the current system were not related to technology, but rather factors such as regulations, compliance and market conventions, among

others. When asked specifically about shortening the settlement cycle (regulation and market convention) results were also largely similar.

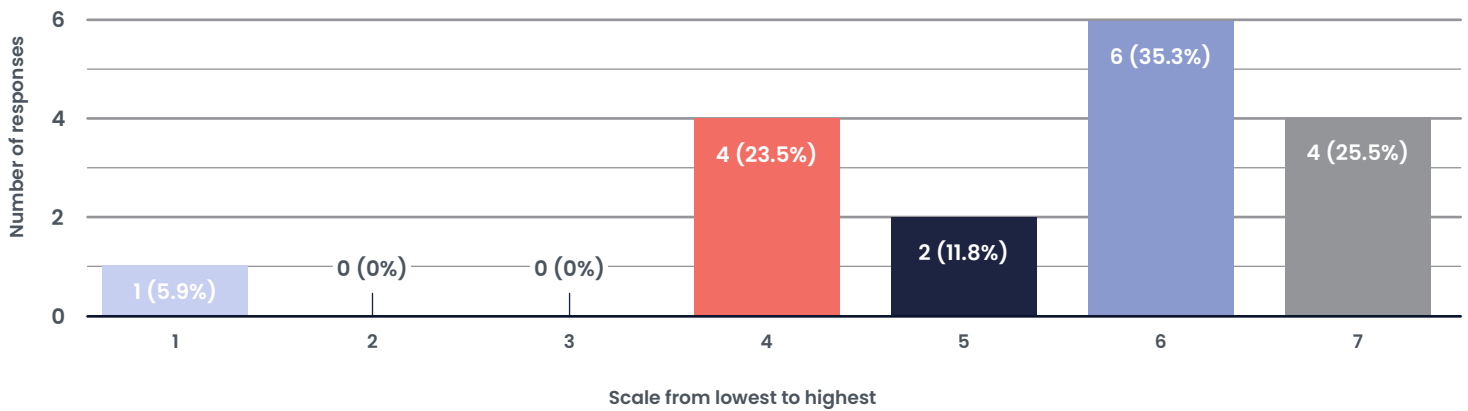
The live cycle of a trade that current exists is inefficient for technology reasons:

17 responses



Shortening the settlement cycle through digital assets can create significant value to my business:

17 responses



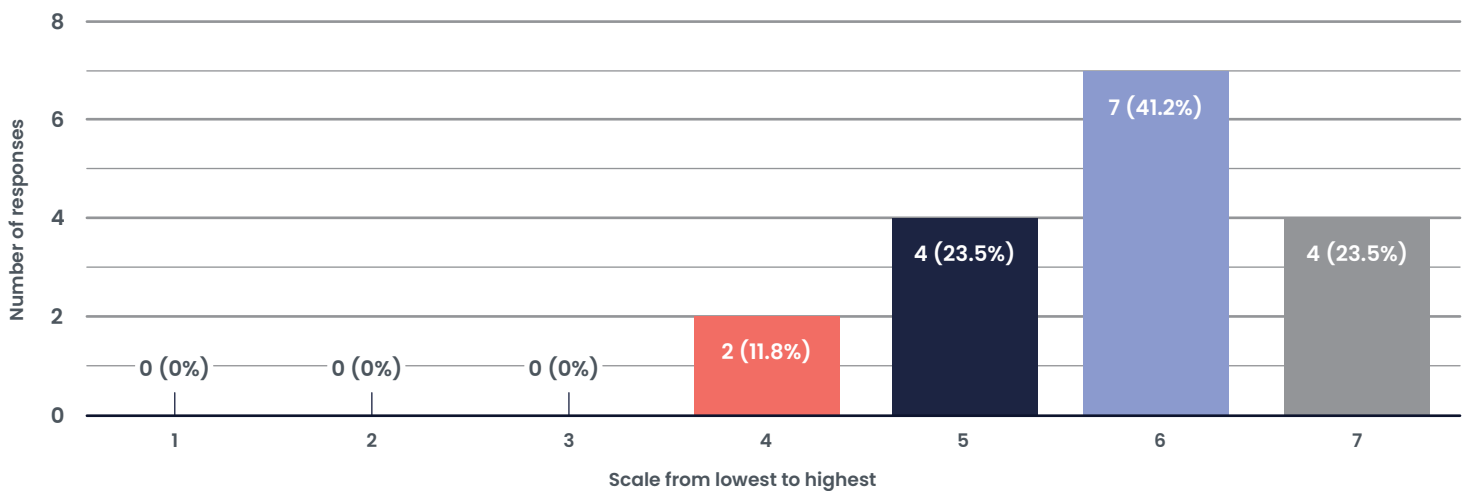
Respondents were positive towards the notion of smart contracts and distributed ledgers acting to automate and enforce some aspects related to the functioning of assets.

Members noted that while automation is generally positive, overly automating could have adverse side effects which could negatively impact the orderly operation of markets. Though

some may view such statements as defensive, repeated histories of flash crashes and strict adherence to codified policies have resulted in the need to roll back or alter trades.

Codifying, and digitally enforcing certain behaviors of assets would improve my business:

17 responses



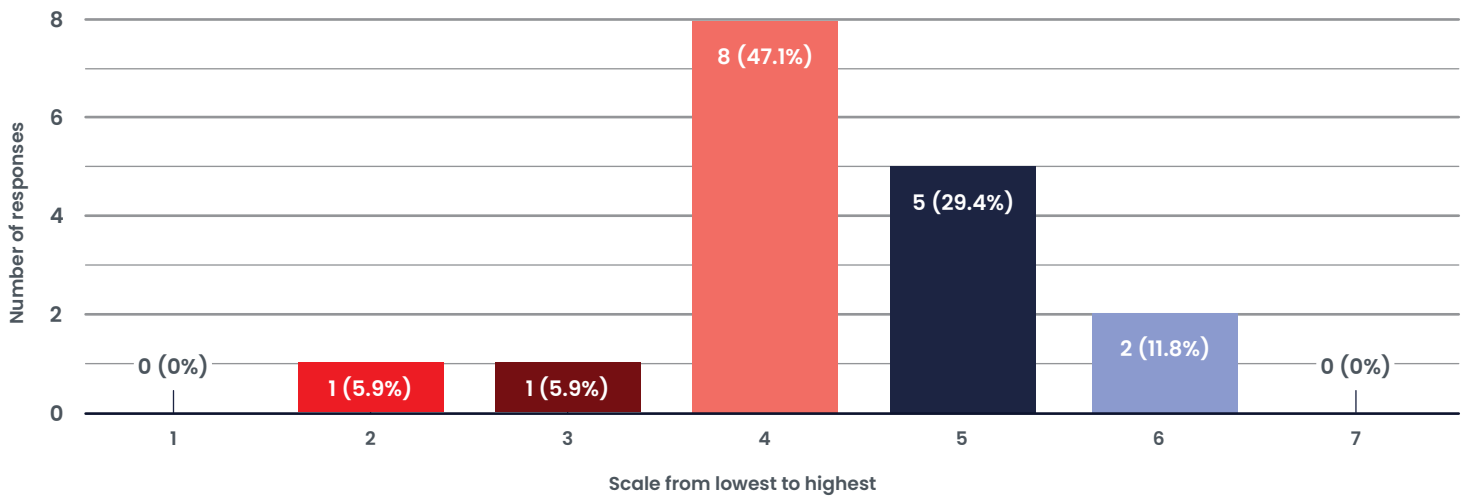
Though members have noted numerous benefits of tokens and distributed ledgers, they noted that many proposed use-cases came up short when upfront investments and all-in

operations costs are considered. Respondents of the survey mirrored this sentiment, noting that they had only seen a few potential avenues which could truly propel them to make the

investments to realize the gain. This is a key aspect that solution providers should factor into their proposals that leverage radically new operations methods.

The benefits provided by digital assets greatly outweigh the costs and investment required for my business to adopt them:

17 responses

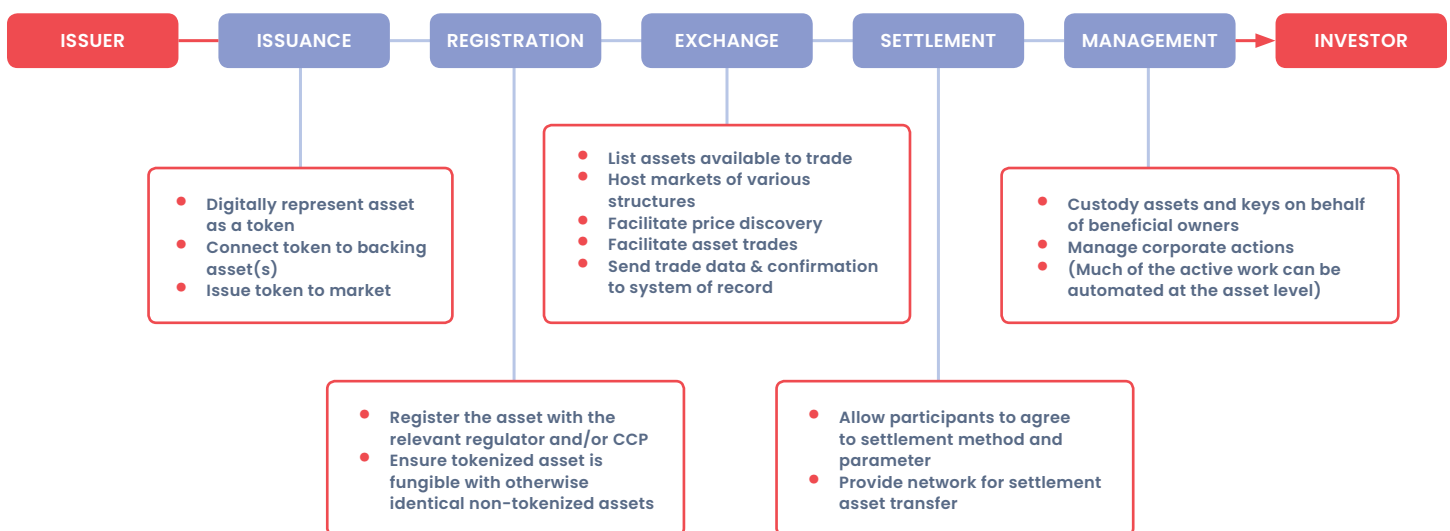


Drivers for adoption across the digital asset value chain

This section walks through the lifecycle of digital assets, providing an overview on the work required for digital assets to exist within regulated capital markets. For tokens to be used as financial instruments, the entire lifecycle of the assets will need to reflect, or at least account for features of traditional assets. The

asset lifecycle can be broken up into five major categories: issuance, registration, exchange, settlement and management. Within each of these stages, adoption of tokens will vary based on customer base, functionality, definition, and classification under law.

Digital Asset Value Chain



Issuance

One of the first questions token issuers face is how to initially offer assets on blockchain platforms. These are operational concerns, focused on how the asset is modeled, defined, and how the features of a digital asset work. For example, tokens must represent assets and agreements in digital form. One feature of tokens is that data is contained in the asset itself. Additionally, in order to be understood, they must fall under a clear taxonomy of assets and market-accepted definitions of asset characteristics and abilities.

Registration

Tokens must also integrate within existing financial infrastructure. This means that the assets must both integrate technically, and the bookkeeping techniques must account for these new assets that firms hold. For example, currently securities must be registered with multiple bodies. Tokens must follow this path, and gain recognition with relevant authorities such as CSD, SEC, IRS, etc., Moving forward, tokens could either reflect registered status in the asset itself as a data field or characteristic of the asset itself. This instruction could come from almost any participant: Issuer directly, issuance platform, exchange, custodian.

Additionally, assets issued on a blockchain platform must be fungible with assets previously registered without blockchain applications. Mirroring the

registration process of existing assets is a critical step.

Exchange

One of the most obvious determinants of any asset's longevity is its demand by investors. Since tokens are a new way of representing an investment, usage rests confidence in both the asset's value and the infrastructure through which it is traded. This value must be tangible and convertible into other assets or trusted sources of value. Counterparties must be able to agree on prices and transact on existing markets with liquidity and systems integrated to OMS tools. Additionally, due to the regulated nature of financial services, these trading parties need to exist within a perimeter of KYC checks. Finally, the parties will require full knowledge of – and confidence in – the settlement process.

Settlement

Settlement is frequently discussed in conjunction with blockchain, but the role of blockchain in settlement is often confused – as there are multiple possibilities. Blockchain can either serve as the delivery leg for assets settled elsewhere. Alternatively, blockchain can be used for payments to settle assets directly. As a result, tokens will need to have a mechanism for settling transactions either on- or off- blockchain platforms. Settling on-blockchain platforms may require settlement assets to exist on ledger, such as a stablecoin or other cash

instrument. Settlement off-blockchain can occur through existing networks, where transactions are simply mapped to the payment process

Additionally, blockchain based settlement can serve additional benefits aside from allowing tokens to be traded with a guarantee of payment. In some scenarios, settling on blockchains provide benefits simply for payments, as they can shorten the post-trade process. Regardless, any assets settling on- or off- blockchain must confer a sufficient degree of finality.

Management

Tokenization provides an opportunity to improve the management of financial assets by encoding features into the asset. There has been much research on specific areas where tokenized assets provide unique value – for example, reflecting facts from external sources. Tokenized assets decouple the responsibility from proving single-spend and services – providing potential for users to have more control. With tokens, custodians can either provide private keys or assets themselves (or both). However, custodians must still integrate with OMS tools and represent asset characteristics to relevant registration authorities.

General

There are many network level improvements that need to occur before financial assets existing on these blockchain platforms

can become mainstream. These surround scalability, privacy, interoperability and identity. First, each step in the value chain must support scale demands of market as-is. This is especially true in integrations to exchanges. Second, each transaction must be confirmable without broadcasting data to every participant in the network. Third, applications addressing one or more steps in the value chain must integrate with legacy systems. And fourth, network participants must be able to find trading parties. Network participants must be able to share their verified identity and verify the identities of their trading counterparts.

The following section will abstract away from the digital asset value chain, focusing on the types of tokens, and how they can be best classified and understood. Later sections will elaborate on governance and legal questions

relevant across certain stages of this value chain.

Token Definitions & Taxonomy

Many have attempted token taxonomies. In the interest of standardization, the DAWG decided against creating competing standards.

Rather, the DAWG uses Global Digital Finance's (GDF) taxonomy. The GDF taxonomy contains the following three top-level label categories, which are not necessarily mutually exclusive:

- 1. Payment Tokens: Tokens whose intrinsic features are designed to serve as a general-purpose store of value, medium of exchange, and/or unit of account.**

- 2. Financial Asset Tokens: Tokens whose intrinsic features are designed to serve as or represent financial assets such as financial instruments and "securities".**
- 3. Consumer Tokens: Tokens that are inherently consumptive in nature, because their intrinsic features are designed to serve as, or provide access to, a particular set of goods, services or content.**

They further note that, these categories are designed in reference to a token's "intrinsic" features – i.e. the actual functions that are coded into the tokens and the networks and platforms on which they operate. However, price volatility, transaction cost acceptance, tax treatment, cybersecurity are among the hurdles faced by these and payment tokens achieving more widespread acceptance as a store of value or medium of exchange.

TOKEN TAXONOMY

Asset-like things	Native token Can the asset be issued directly on to the ledger?	Depository receipt The asset exists off ledger but can a depository issue a receipt representing the thing on ledger?	Asset of Which party is entitled to the risks and rewards?	Liability of Which party holds the ultimate financial obligation?		Redeemable Can the token be redeemed for some form of consideration?		Fungible Can the token be mutually interchangeable with others of the same type?	Represented	
				When issued as a native token	When issued as a depository receipt (depository always has a liability)	When issued as a native token	When issued as a depository receipt			
Asset-like things	CBD	Yes	Token holder	Central bank	Token issuer	Yes	Yes	Yes	Fungible Token / NonFungible Token	
	Cryptocurrency	Yes	Token holder	No-one	Token issuer	No	Yes	Yes	Fungible Token / NonFungible Token	
	E-money	Yes	Token holder	N/a	Token issuer	Yes	Yes	Yes	Fungible Token / NonFungible Token	
	Commodity	No	Token holder	N/a	Token issuer	N/a	Yes	Yes	Fungible Token / NonFungible Token	
	Physical stuff	No	Token holder	N/a	N/a	N/a	Yes	Yes	Fungible Token / NonFungible Token	
	Real estate	No	Token holder	N/a	N/a	N/a	Yes	Yes	Fungible Token / NonFungible Token	
	Equity	Yes	Token holder	Issuing company	Issuing company	No	Yes	Yes	Fungible Token / NonFungible Token	
	Fixed Income	Yes	Token holder	Issuing organization	Issuing organization	Yes	Yes	Yes	Fungible Token / NonFungible Token	
	Contract-like things	OTC Option	Yes	Depends on fair value	Depends on fair value	Depends on fair value	Depend on contract	Depend on contract	No	SDA CDM
		Exchange traded option	Yes	Depends on fair value	Depends on fair value	Depends on fair value	Depend on contract	Depend on contract	Yes	SDA CDM
Exchange traded future		Yes	Depends on fair value	Depends on fair value	Depends on fair value	Depend on contract	Depend on contract	Yes	SDA CDM	
Forward		Yes	Depends on fair value	Depends on fair value	Depends on fair value	Depend on contract	Depend on contract	No	SDA CDM	
OTC Swap		Yes	Depends on fair value	Depends on fair value	Depends on fair value	Depend on contract	Depend on contract	No	SDA CDM	
Exchange traded swap		Yes	Depends on fair value	Depends on fair value	Depends on fair value	Depend on contract	Depend on contract	Yes	SDA CDM	
Repo		Yes	Depends on fair value	Depends on fair value	Depends on fair value	Depend on contract	Depend on contract	No	SDA CDM	
Obligations	Obligation	Yes	Obliger	N/a	N/a	Yes	N/a	No	Obligation	
	Loan	Yes	Lender	N/a	N/a	Yes	N/a	No	Loan	

1. Depository receipts issued in respect of real-world things can be issued as fractions of the single real-world thing. Hence pretty much everything can be fungible.
2. For depository receipts, the token issuer always has the ledger liability. However, the party with the ultimate liability is likely a different entity, as the table alludes to.
3. With ledger native tokens, the party with the on ledger liability and the ultimate liability is the same party.
4. Crypto-currencies have no issuer (e.g. a Bitcoin confers no rights).

The group also recognized that within each type of token, and in particular Financial Asset Tokens, the underlying asset can alter how a token is used or viewed by an owner, as well as from a variety of legal lenses. The team at R3 has previously designed a model to categories a variety of asset and agreement types. It demarcates assets as having a relationship with an issuer and owner, whereas contracts are rights between two or more counterparties.

Defining tokens

One debate that the working group received a lot of interest in was how to define digital assets, and specifically crystallise what defines tokens. While the goal was not to derive a concise definition, favoring an approach that yielded insight to what classification or exclusion from that category could mean.

An initial approach, looked at tokens in the context of physical security devices:

Building on the concept of security tokens—physical devices, like RSA’s SecurID, which allow the holder to access an electronically restricted resource through cryptographic methods—digital tokens, or ‘crypto assets’ allow the holder of a cryptographic proof to make changes to identifiable units registered on a distributed ledger (which could include a blockchain).

By virtue of their construction and placement on a distributed ledger, the entire history of digital tokens can be traced back to the moment they were created or issued.

Digital tokens function differently from dematerialized assets, in that they are individually identifiable, and can only be affected by the holders of the cryptographic proofs for those unique digital tokens.

Digital tokens are not themselves valuable but are valued based on the context given to them, either their usage, or as an exchange for an otherwise valuable asset (tangible, such as goods and services, or intangible such as ownership in a company).

Participants noted that this definition, whilst potentially helpful on certain aspects, could be too restrictive, advocating for a wider approach.

This led the group down a path of looking at the use of the term “token” before cryptocurrencies when “token” was used for data structures where “tokens” were commonly used for cryptographic techniques where the token itself was a “stand-in” for shared secrets but had no value in itself. It was acknowledged that this would be an incorrect way to look at the assets participants were concerned with as losing private keys would result in the complete loss (in the case of Bitcoin) or temporary loss, until an administrator can re-issue (still theoretical or limited to prototypes).

So, returning to the notion of “digital assets”, one could quickly separate two major types of digital assets. Firstly, those which resemble balances held purely in digital formats (e.g., e-money, central bank deposits). The second is something

newer, which is typified by a cryptocurrency (e.g., Bitcoin, Ether).

The group decided to focus on the latter, as the former was widely understood as something different.

In the initial definitions above, cryptography was part of the solution, but it was noted that most electronic money is already secured by cryptography in one way or another. Therefore the heart of the second portion of the difference, that instructions are fully self-contained, meaning once an instruction (e.g., to move an asset) are sent there aren’t any further external points on which one needed to rely. Contrast this with e-money in a PayPal, which requires the user to log into their account and send a valid instruction to PayPal who in turn sends an instruction to their banking partners (after netting), who in turn make movements at the central bank (after netting). Perhaps a title for these types of assets are “cryptographically-secured assets”. It was also noted that, while one can conduct a fully self-contained transaction, they can also opt to delegate this function to a custodian, in full (fully hosted) or in part (multi-sig accounts). Participants also asked the question of whether the “digital” element is a necessity, one could (at great physical expense) manually recreate a Bitcoin network (and therefore its tokens) using only paper and a pen. They can also print out paper wallets and move Bitcoin/Ether, those this requires trusting the party which provided the paper wallet to not create a competing transaction.

The other thing aspect that was considered was the difference between the legal effect of making a transaction. A cryptocurrency or rematerialized security becomes the binding part of the transaction, which could be akin to the “cryptographic” equivalent of moving physical allocated gold. One can individually and uniquely identify the asset and manipulate that asset. There is probably another term for cryptographically-secured assets, which whilst being fully self-contained, rely more on trust in other types of structures (usually legal claims) to derive the final transaction. This could look more like a depository receipt or claim on unallocated gold, which whilst a claim on something is otherwise not directly 1:1 and pushes toward the creditworthiness of the guaranteeing institution.

Token Data Structures

The working group also noted the numerous projects looking to build token standards and designs. These projects appeared in most permissionless and permissioned DLT platforms which allowed some form of tokenization, including Ethereum (ERC20, ERC777, etc....), Stellar, Fabric (FabToken), and Corda (Token SDK). While these standards, and proposals, ranged in functionality from highly simplistic to complex data structures, the working group identified potential areas of further investigation with regard to how data is shared within the distributed ledger vis-a-vis the

token design and compliance with existing financial regulations.

Permissionless smart contract platforms, such as Ethereum, have gained relatively significant traction amongst projects looking to create tokens which can be transferred amongst participants. The most notable format being Ethereum’s ERC20 token standard. Whilst not designed to exclusively facilitate financial instruments, some projects have explored this possibility, either intentionally or inadvertently due to regulatory advice that such projects may be viewed as financial instruments.

The ERC20 token standard was purposely designed to offer simplistic functionalities within the Ethereum platform. Holders can send programmatic instructions to the platform, which include:

- **Transfers to another Ethereum address,**
- **Checking the balance of tokens within an address, and**
- **Approval to another entity to withdraw up to a certain amount of tokens.**

In addition to these functions, the Ethereum platform keeps a relatively small amount of data about a specific issuance of ERC20-type tokens, including:

- **Total supply,**
- **Name,**
- **Ticker,**
- **Divisibility (level of precision to which each token can be broken down to), and**

- **Creator (entity initially issuing the token)**

Those specifically looking to create a financial instrument, have focused primarily on adapting simplified token standards, such as the ERC20, to include additional functions and information that offer the ability to give certain entities the power to approve only certain transfers, the creation/redemption of tokens to adjust the total supply, as well as white/black listing.

Whilst such functionality was certainly developed to meet regulatory requirements perceived by projects, the working group noted that in doing so projects offering regulated financial instruments may run afoul of other rules embedded in regulations. One such example was the development of a so-called “partially fungible token standard”, which may violate rules governing the fungibility of certain classes of financial instruments under MiFIDII.

Taking the example of a German registered financial instrument, which has the characteristics of a sovereign/supranational/agency (SSA) bond, issued as a token would likely need to adhere to the following rules when designing the functioning of their token data structure:

- **MiFiD II,**
- **German Securities Trading Act (Wertpapierhandelsgesetz),**
- **German Securities Prospectus Act (Wertpapierprospektgesetz),**

- **German Capital Investment Act (Vermögensanlagengesetz),**
- **German Banking Act (Kreditwesengesetz),**
- **German Capital Investment Code (Kapitalanlagegesetzbuch),**
- **German Payment Services Supervision Act (Zahlungsdiensteaufsichtsgesetz),**
- **German Insurance Supervision Act (Versicherungsaufsichtsgesetz), and**
- **German Civil Code (Bürgerliches Gesetzbuch)**

Depending on where and how these tokens are issued, registered and traded, there may be additional rules which apply. This is also does not account for other jurisdictional rules which may apply if the token is traded, cleared, settled, held, etc... in other jurisdictions.

Amongst the considerations, a token SSA bond falling under German jurisdiction would likely need to meet the following criteria and have data stored in relation to its issuance, trading, clearing, settlement and custody.

SUP-TYPE	DIMENSION	PROPERTIES	TYPE	CHARACTERISTIC (EXAMPLE)	
SSA Bond	Legal	Securitization of rights	Transparency	e.g., information/ prospectus	
		Fungibility	Marketability	e.g., mutual interchangeable	
	Technical	Static data	basic	Tradability	e.g., prim./ sec. market, OTC etc. (liquidity)
				Identifier codes (e.g., Isin, German VKN)	
				Issuer (LEI)	
				IssuanceDate	
				Total amount issued	
				Day-count convention	
			non-basic	Maturity	
				MaturityDate	
				Coupon type (i.e. fixed, floating, indexed)	
				Coupon	
				Currency	
				Rating (Fitch)	
				Rating (Moody's)	
				Rating (S&P)	
				Coupon payment dates (each)	
				Coupon payment dates (first)	
				Disbursement amount	
				Status	
Knowledge and experience					
Financial situation with a focus on the ability to bear losses					
Clients' Objectives and Needs					
Expected investment horizon					
Risk-attitude					
Distribution strategy					
Dynamic Data	Beneficial Owner				
	Custodian				

In addition to these criteria and data, a financial intermediary and issuer may also need to consider how they match the following dataset with regard to trading activity:

- **Off chain cash payment addresses**
- **Product category**
- **Client category**

While potentially daunting for those creating offerings and services on new technology, the working group noted that compliance with such rules are the reality of operating regulated financial functions.

Working group participants highlighted that data linked to tokens, and their secondary markets activity may not all need to be lodged within a distributed ledger. A view was that data linked to tokens can be held in three ways:

- **Distributed ledger - at the lowest level, and attached to the asset (e.g., ERC20 Token name),**
- **Common service - data held centrally and accessible by participants (held at a registrar and accessible via API call), or**
- **Held individually - data held by participants requiring such data and reconciled against records held by other parties.**

Each method comes with benefits and trade-offs, however depending on what is being shared and rules governing the

operation and sharing of data a mixture of approaches may be required.

Specific implications for tokens in financial markets

Key Regulatory Considerations for Tokenizing Assets in the EU and UK

1. **Is the asset a financial instrument or other regulated asset?**

EU regulators have consistently reiterated that they take a technology neutral approach to regulating innovation¹. This is important because it clarifies that the existing regulatory perimeter and definitions apply to tokenized assets as they do to traditional asset classes. Accordingly, as for traditional asset classes, the most important gating question under EU regulation relating to tokenized assets is whether the tokenized asset is a “financial instrument” or other regulated asset? Answer that question in the affirmative and the tokenized asset will fall within the regulatory perimeter, resulting in licensing, organizational and conduct of business requirements on entities and intermediaries involved

in such transactions. Answer that question in the negative and the tokenized asset will fall outside the regulatory perimeter (although consumer protection legislation may continue to apply).

Financial instruments are defined in the EU’s Markets in Financial Instruments Directive II (2014/65/EU) (“MiFID II”) as:

- **i) transferable securities (such as shares, bonds, depositary receipts, etc.);**
- **ii) money-market instruments (i.e., treasury bills, certificates of deposit and commercial paper);**
- **iii) units in collective investment undertakings (such as fund interests);**
- **iv) emission allowances; and**
- **v) various kinds of derivatives.**

However, given that MiFID II is an EU directive, it requires implementation into the national laws of each EU member state. Consequently, although MiFID II represents a harmonized EU level regulatory framework in relation to financial instruments, it may have been implemented differently and/or subject to different interpretations across member states. In the UK, for example, whether or not a tokenized asset will fall within the regulatory perimeter generally depends on whether the tokenized asset falls within the UK’s Financial Services and Markets Act (Regulated Activities) Order 2001 (2001/544) (the “RAO”). While the RAO is drafted to cover

¹ See, for example, the European Securities and Markets Authority (ESMA) Advice to the European Union (EU) Institutions on Initial Coin Offerings and Crypto-Assets, dated 9 January 2019, and UK Financial Conduct Authority’s proposed Guidance Consultation on Crypto-Assets (CP19/3), dated 23 January 2019.

the totality of MiFID financial instruments, it is broader in scope and covers a range of UK-specific asset classes not covered by MiFID.

It is, therefore, necessary to take into account the characterization of a tokenized asset both in the jurisdiction in which the issuer is based, as well as the jurisdiction in which investors are located because the regulatory characterization of the tokenized asset in each may differ, resulting in different regulatory outcomes across borders.

In addition, EU regulation covers a number of other types of regulated asset which fall outside the definition of a financial instrument and which are subject to different regulatory regimes, for example electronic money, insurance contracts and pension contracts.

Given that the focus of this paper is on the tokenization of transferable securities (the type of financial instrument covering equity and transferable debt instruments) and since the regulatory position relating to licensing and conduct of business requirements is generally well understood, the discussion in this paper is limited to two other fundamental regulatory questions in relation to financial instruments under EU regulation:

- **i) is it necessary to involve a central securities depository (“CSD”) in every tokenization project involving financial instruments in the EU; and**

- **ii) what does it mean to take custody of tokenized assets and what are some of the challenges that must be overcome?**

2. The need for a CSD

The Central Securities Depositories Regulation (236/2012/EU) (“CSDR”) came into force on 17 September 2014 and was introduced to harmonize the regulation of a market that had settled over one quadrillion (1,000 trillion) worth of transactions in the two years before its introduction. CSDR is an EU regulation, meaning that it is directly applicable in the laws of EU member states (in contrast to EU directives like MiFID II which must be incorporated into member state laws by the member states themselves).

One of the fundamental principles of CSDR is that securities should be dematerialized – that is, recorded electronically in book-entry form through a CSD – from the moment that they are traded on an EU trading venue. This principle is codified in Articles 3(1) and 3(2) of CSDR. Article 3(1) requires an issuer established in the EU that issues or has issued transferable securities which are admitted to trading or traded on EU trading venues² to arrange for such securities to be represented in book-entry form. Article 3(2) goes further by requiring that where a transaction in transferable securities takes place on a trading venue the relevant securities shall be recorded in book-entry form in a CSD.

Furthermore, where transferable securities are transferred following a financial collateral arrangement as defined in point (a) of Article 2(1) of Directive 2002/47/EC, those securities shall be recorded in book-entry form in a CSD on or before the intended settlement date, unless they have already been so recorded.

CSDR, therefore, distinguishes between transferable securities actually traded on a trading venue (where Article 3(2) will apply) and those which are admitted to trading but not, in fact, traded (where Article 3(1) will apply). Transferable securities which are admitted to trading on a trading venue (but not traded) are not required to be recorded in dematerialized form in a CSD. However, transferable securities which are admitted to trading on a trading venue (but not traded) must be represented in dematerialized form from 1 January 2023 in relation to new issuances and from 1 January 2025 in relation to existing issuances, although this need not necessarily be in a CSD (other entities, such as a registrar, may suffice). Conversely, where transferable securities are actually traded on a trading venue they must be recorded in book-entry form in a CSD.

These rules apply equally to tokenized transferable securities. Therefore, a distinction can be made between tokenized transferable securities which are either (i) not admitted to trading on an EU trading venue or admitted to trading but only

² Trading venue as defined in article 4(1)(24) of MiFID II, meaning this is limited to trading venues that are licensed to operate as (i) an organised trading facility (ii) a multilateral trading facility or (iii) a regulated market.

traded on an OTC basis; and (ii) admitted to trading and traded on an EU trading venue. The former will not be required to be dematerialized on the books of a CSD, whereas the latter will. This is at present a crucial distinction because while EU CSDs are reportedly exploring the possibility of servicing the tokenized security market, at present we are not aware of any EU CSDs willing to provide depositary services in relation to tokenized assets.

The CSD's settlement engine would also need to be designated as a securities settlement system under the Settlement Finality Directive (2009/44/EC) ("SFD") in order to ensure EU-wide settlement finality for transactions. There is some debate as to how settlement finality should apply to a securities settlement system utilizing distributed ledger technology³. While it should be possible to design such a system in a way that complies with the stipulations of the SFD and which, therefore, provides participants with the protections of settlement finality, the requirement under the current rules for a "system operator" would seem to inherently disallow truly decentralized "permissionless" systems from designation under the SFD on the basis that such systems are not operated by any participant or controller. Note that CSDR provides that only a CSD may operate a designated securities settlement system.

3. Custody of tokenized assets: some legal challenges

The core function of a custodian is to provide "safekeeping" services to investors. However, what safekeeping involves has changed dramatically over time with the evolution of technology. Historically, a custodian (normally a bank) would hold its clients' physical paper securities safe in its vault with clearing and settlement of these paper securities effected by transfer of the physical paper – messengers would be sent to deliver paper stock certificates by hand. This was an inefficient and manual process and has now largely evolved into a modern computerized book-entry custody chain in which custodian banks hold beneficial title to securities on behalf of investors through their accounts in CSDs, with a CSD's books and records providing the highest root of title.

However, the conception of safekeeping is evolving once more with the advent of tokenized assets. This is because tokenized assets are typically "held" in a digital wallet and transfers of tokenized assets are authenticated by the holder of the wallet using a private key which is stored in that wallet. Therefore, rather than a custodian authenticating the transaction based on its books and records showing ownership of securities, with tokenized assets whoever holds the private key has the power to effect a transfer of the tokenized assets

"held" in the digital wallet in which that private key is stored. The private key is, therefore, similar to the historical physical certificate which demonstrated ownership of securities prior to the advent of electronic book-entry systems.

There is no legal or regulatory requirement for a custodian to safekeep a private key and owners of digital assets can choose to safekeep their own private keys outside of any custody arrangements. However, as was historically the case for physical certificates, security concerns are creating demand for new custody solutions to protect private keys. These solutions range from fully-hosted custody services (where a customer pays a custodian to safekeep private keys on the customer's behalf), self-custody solutions (services which provide an additional security layer around the customer's private keys which are still held by the customer), and hybrid models (for example, where two keys are needed to sign a transaction with one key being held by the customer and another being held by a custodian).

Safekeeping and administration of financial instruments for the account of clients is classified as an ancillary activity under MiFID II, meaning that providers of those services do not require a license unless they also provide other investment services under MiFID II. However, individual member states may gold-plate MiFID II

³ See ESMA Advice to the European Union (EU) Institutions on Initial Coin Offerings and Crypto-Assets, dated 9 January 2019 for a discussion of the key issues.

and many have introduced a separate licensing requirement for the provision of custody services. For example, in the UK safeguarding and administration of assets is a standalone regulated activity. However, while the FCA has confirmed that safeguarding and administration of tokenized securities would fall within the scope of the regulatory perimeter, it is not entirely clear what safeguarding and administration of tokenized securities comprises. The better view appears to be that safeguarding and administering private keys on behalf of the owners of the assets to which those private keys relate would constitute the regulated activity of safeguarding and administering assets in the UK.

However, even if that is the case, there are still a number of open questions in relation to the custody of tokenized assets which will need to be clarified by regulators and/or legislators:

- **The UK's Client Assets rules impose a number of ongoing requirements on custodians, including the requirement to perform daily internal and external reconciliations of asset ownership. While these concepts are well understood in relation to traditional financial instruments, it is not entirely clear what external reconciliations would involve in the context of tokenized securities created on a DLT infrastructure. For example, would it be enough to ensure that the custodian's own records of asset ownership match the DLT ledger or is something more required?**

- **Will these new custody providers also provide the vast range of security services provided by traditional custodians, including managing payment flows (e.g. relating to dividends and coupons), corporate actions, administration services and granting intraday credit on a global basis? If not, who will provide these services?**
- **If new custody providers do manage payment flows, how will cash funds be held on behalf of the customer? The UK's Client Assets rules require client money to be deposited in accounts held with a central bank or third-party bank or in qualifying money market funds. Compliance with these requirements will place restrictions on the ability of a new custody provider to run its custody services through a single cash and assets wallet.**

Tokenomics & governance sub-group input

Companies that are developing and distributing digital assets ("Digital Asset Developers") will rely on blockchain infrastructure for sales, custody and ownership of such assets, and they need to carefully consider how such infrastructure is governed. Blockchain infrastructure is still evolving, and the governance of such evolution will be critical to the success of the Digital Asset Developer.

The blockchain infrastructure is likely to have several levels: the blockchain platform, in some cases a second layer of

technology providing additional functionality, and potentially a third layer of companies working together through a consortium. These consortiums are forming in many industries to deal with the particular problems of those industries.

The governance of the major public blockchains, Bitcoin and Ethereum, is ad hoc and difficult to understand; it is run primarily by the relevant "core developers" through BIP and EIP procedures.

A recent article in Decrypt summarized the governance issues in the context in the recent debate over the adoption of ProgPoW as follows: "One of the most interesting aspects of the Ethereum platform is that has no centralized decision-making process. Like other improvement proposals, ProgPoW was debated both online and via biweekly core developer calls until a consensus is deemed to be reached. How that happened, and whether community members were given enough of a voice, has been the subject of much debate. Now that this is subsiding, the absence of established mechanisms for dealing with this sort of thing is taking its place. Rettig, who is part of the project management group known as the Ethereum Cat Herders, has been at the center of the governance row. He had clearly reached breaking point when he posted his weekend tweet, followed by a stream of others to explain his reasoning. "Essentially, developers are not keen to make decisions on non-technical issues, which are political in nature and the

Ethereum Foundation, will not step up to the plate for decision making, for fear of taking sides. It is, in fact, trying to move further into the shadows.”

Other blockchain platforms have taken a more traditional approach. For example, the Corda Network will be run by an independent foundation, which will include a governing board, a technical advisory committee, a governance advisory committee, and a changeable network operator. Another example is the Hedera Hashgraph ecosystem will be run by a 39-member governing council through a Delaware limited liability corporation, Hedera Hashgraph LLC.

The Digital Asset Developer also needs to consider the incentives and other economic issues in the design of the blockchain ecosystem which it intends to employ for its digital assets. The Prysm Group, a leading blockchain economic consulting firm, summarizes these issues as follows: “Blockchain protocols and apps are economic systems that provide participants with infrastructure that allows them to coordinate their activities and create value. The design of that infrastructure needs to facilitate value-producing transactions and incentivize beneficial behaviors in order for the platform to be successful.” They note that the design of a token ecosystem has five elements: (i) contract design (ii) market design (iii) information systems (iv) token economics and design and (v) governance. They go on to note, “Governance

is the set of decision processes or systems that allow for a platform to adapt over time to changing conditions or new information. The design of a governance must be flexible enough to allow for adaptation under unforeseen circumstances, which is when it will be most needed. However, rules, mechanisms, and processes are typically put into place in order to ensure that the needs of particular stakeholders, such as platform users, are served decisions that result from a governance system. The economic fields of social choice (the study of decision making by groups) and contract theory (which covers decisions made by representatives) both provide frameworks for analyzing the quality of a governance system.”

The Digital Asset Developer needs to consider how each level of the blockchain ecosystem is governed, including the stability and predictability of such governance procedures and how the governance procedures will interact. Many of these governance decisions will be implemented in software, frequently software licensed under open source software (“OSS”) licenses. And many of the governance issues of the blockchain projects in the ecosystem will be similar to the governance issues solved (and continuing to be solved) by OSS projects, such as Linux and OpenStack. Although the governance of for-profit entities may also be helpful, the governance of collaborative projects like OSS projects and blockchain projects are quite different from governance of

traditional for-profit companies.

The DA Asset Developer need to consider the following issues the organization of a blockchain consortia or joining a blockchain consortia should consider the following key issues:

- 1. Identifying classes of stakeholders:** The classes of stakeholders in the blockchain projects need to be identified in order to determine how such stakeholder classes will be represented and how the authority to make decisions will be allocated. These stakeholders may include miners, software developers, investors (in some cases), project users, companies involved in a particular consortia, service providers to companies which are users (for example, freight forwarders in logistics blockchain project consortia), academic institutions and nonprofit foundations. These stakeholder classes may vary over time.
- 2. Processes for proposals for changes.** The Digital Asset Developer should understand how changes to the blockchain ecosystem can be proposed and decided. These changes should be planned with consideration for iterative input and response, drafts, and a definite commitment to code. If the blockchain project uses off chain governance through an entity, the change proposals can be made through the board of directors or similar governing body.
- 3. Decision making.** Although many blockchain communities are eager to make use of

“on-chain” governance and “virtual organizations” such as decentralized autonomous organizations (DAO), these approaches are new and have many uncertainties. The Digital Asset Developer should carefully consider the risks of such new procedures. For example, the first major decentralized autonomous organization, The DAO, was a failure due to errors in the smart contracts that were supposed to run the organization.

The Digital Asset Developer should consider using off-chain governance through traditional legal entities for its blockchain infrastructure. This system generally means decision making through “representatives”. This approach has worked well in OSS projects: a non-profit foundation with a board representing the different stakeholder classes.

The major issues relating to the board for blockchain projects are: number of members, method of appointment or election for the members, term of the members (frequently annual), quorum (the number of members needed to transact business), percentage votes for approval of proposals (and any special percentages for certain proposals) and any limit on affiliated entity on the board (i.e., many projects limit the number of members from “affiliated entities” such as subsidiaries and also deals with consolidation through mergers or other corporate transactions). The Digital Asset Developer needs to consider the risk that if a board becomes too large, it can be difficult to operate effectively.

On the other hand, the board needs to represent the major stakeholders in the blockchain ecosystem.

The terms of the board members will depend on the blockchain project and the value of “institutional memory”. The quorum will depend on the size of the board and the need that sufficient stakeholders are present to give the board decisions legitimacy. Frequently, the majority of board members who form a quorum will be the requirement for routine decisions (my experience is that most board decisions in well run projects are unanimous or near unanimous). However, certain decisions may require a higher percentage of votes to ensure their legitimacy; examples of these type of decisions could include changing the size of the board, changing the allocation of board seats among the stakeholder membership classes, changes in consensus procedures, changes to the network protocol, a change in block or transaction validity rules and any change or addition that affects the interoperability of applications using the blockchain project.

Many OSS projects ensure that a single entity (or group of affiliated entities) does not obtain undue influence over the project by limiting the number of board members who can be from a particular entity or group of affiliated entities. This limit is frequently referred to as a board diversity requirement and also applies to an increase in the number of board seats

held by a single entity or group of entities arising due to a merger or acquisition.

- 1. Special voting rights for critical issues.** Although board approval is generally used for many decisions, the classes of stakeholder may desire that some decisions require additional approval (such as the approval of the class of stakeholders). The members could also require special class votes for other major issues in the blockchain projects which could include the software license for the project, the policy for use of the trademark for the project and change in decision making on determining future features of the blockchain project.
- 2. Off chain governance: entity selection.** If the blockchain project decides to use off chain governance through an entity, the choices can range from nonprofit foundations to more traditional entities. For example, Delaware is widely recognized as having the most sophisticated corporate law in the United States (and the world) and many new OSS projects are organized as nonprofit, nonstock corporations. On the other hand, Hedera has decided to use a Delaware limited liability corporation. The selection of the type and the jurisdiction this entity will be driven by the location of the founding members of the blockchain project and prospective members as well as tax issues. On the other hand, Switzerland is widely viewed as a “neutral” jurisdiction by many international companies and is the location of a number of the original blockchain

foundations, such as the Ethereum Foundation and the Tezos Foundation.

The Digital Asset Developer needs to monitor the governance of the blockchain infrastructure that it intends to use for the sales, custody and ownership of such assets. Blockchain governance is constantly evolving, and the options will change over time.

One specific area this group is taking forward

Projects going forward

Decentralized Finance

Looking at trends beyond the scope of digital assets alone, the group recognized trends in the wider permissionless blockchain market, notably those demonstrated by the Decentralized Finance or “DeFi” movement.

DeFi, or Decentralized Finance, is the moniker for the latest trend in the Ethereum ecosystem. Sometimes branded “Open Finance”, DeFi seeks to go beyond the original cryptocurrency use cases of payments and crowdfunding (i.e. ICOs) to enable more complex financial operations. At current, some of the focal points are decentralized lending, and

(income-generating) savings, token exchange and prediction (betting) markets. Key to DeFi has been the ability to utilize Ether (ETH) as an underlying source of value upon which to build other financial products. As has been witnessed previously with token sales in 2016/2017, this is not restricted to Ethereum, though this is where more of the projects have been built so far.

Why is DeFi important for financial institutions to watch?

While it is easy for a financial institution to be dismissive of what is happening in cryptocurrencies and permissionless blockchains, there is the potential for some of these projects to showcase the potential market demand for new products built in a technology greenfield. However, many of these projects cannot be directly copied due to their seemingly inability or unwillingness to work within regulatory frameworks, as well as often questionable economics models.

The vision of many of these projects ultimately boils down to a parallel “permissionless” and global financial system based around cryptocurrencies and tokens.

How is DeFi different from what came before it?

Unlike many areas of crypto-assets which seek to innovate whilst remaining compliant with regulations, DeFi seemingly seeks to take the opposite approach.

Most of these projects are built in a way that seeks to leverage the strengths of the decentralized aspects of permissionless blockchains (i.e. censorship resistance and plausible deniability).

Most DeFi projects try to abstract the operation of their services away from anything in the real world, by building all of the functionality in a peer-to-peer network. Much of this is done at the “protocol layer”, which is then dependent on the crypto-asset network (e.g., Ethereum or EOS). Other projects have leveraged other (non-blockchain) peer-to-peer networks which can host and manage some of the functionality for these services (e.g., [Ox Relayer network](#)), ultimately only interacting with a blockchain for a portion of their operations. If successful, at scale, this architecture could potentially remove the ability for developers to control the ongoing operation of their creation. Of course, all of this brings in a myriad of legal and ethical questions, which financial institutions must consider.

Another feature of DeFi is their common utilization of the native cryptocurrencies of a permissionless blockchain, a departure from the ~2013-2017 trend of every project arguing the need for a native currency and network.

One such example is borrowing, and lending based on using Ether for collateral. This stems partially from the relative ease of use, and auditability, of using Ethereum for this purpose (compared with

Bitcoin, which would require developing and managing additional layers to custody the asset). It also has the advantage of not needing to rebuild liquidity for yet-another-coin.

By using a common network and native cryptocurrency, these projects are able to build upon each other (e.g., Decentralized exchanges allow leverage afforded by a decentralized token lending platform).

What are some of the larger projects?

Currently there are a handful of projects, some of the more well-known include:⁴

- **Lending/Borrowing - MakerDAO/DAI, Dharma Protocol, Compound**
- **Token Exchange - Ox, Uniswap**
- **Prediction Markets - Augur**

Next steps

The DAWG will continue as an organization to showcase solutions, assess industry updates, and participate in real applications. As digital asset ecosystem solutions come to market, the DAWG will be an audience to offer validation or correction in the launch process. These solutions will be showcased to the participants as and when they are ready for market input. Additionally, the DAWG will assess industry events as they evolve. The DAWG facilitators will provide a periodic summary of the most important market news. Finally, the DAWG will be a launchpad for digital asset applications. The membership will be opened to all active market participants, and R3 will continue to host the group and provide market updates.

⁴ Note that this is not an endorsement of any project.



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R3 is an enterprise blockchain software firm working with a broad ecosystem of more than 300 participants across multiple industries from both the private and public sectors to develop on Corda, its open-source blockchain platform, and Corda Enterprise, a commercial version of Corda for enterprise usage.

The Corda platform is already being used in industries from financial services to healthcare, shipping, insurance and more. It records, manages and executes institutions' financial agreements in perfect synchrony with their peers, creating a world of frictionless commerce. Learn more at r3.com.